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Entodontopsis (Bryophyta: Stereophyllaceae) new to the Australian flora

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Abstract

The genus *Entodontopsis* (Bryophyta: Stereophyllaceae) is reported as new to the Australian flora, based on a recent collection from northern Queensland identified as *Entodontopsis pygmaea*. This species was previously known from Vietnam, Thailand, China, India and Nepal. It is distinguished in the Australian flora by the procumbent habit, complanate ovate-ligulate leaves, presence of a costa failing in the upper half of the leaf, weakly denticulate leaf margin, smooth long-linear cells in mid-lamina, and gradually differentiated rectangular to rhomboidal alar cells. The likely type locality for the species, previously uncertain, is identified.

Introduction

We recently collected bryophytes at Lake Barrine National Park, on the Atherton Tableland in northern Queensland, in the Cook botanical district (Henderson 1974). Among our collections was an unusual epiphytic moss (Fig. 1) that we were unable to identify to genus using the current moss key for Australia (Buck and Vitt 2006). The leaf shape, the presence of a costa and the large patches of quadrate alar cells slanting up towards the leaf margins led us to think it might belong in the Stereophyllaceae. The plant has a superficial resemblance to *Stereophyllum radiculosum* (Hook.) Mitt., a widespread tropical species that has been recorded from the Einasleigh Uplands and Northern Brigalow Belt regions of north eastern Queensland, but that has rhomboidal laminal cells and a stout costa to 80% of the leaf length, whereas our plant has long, smooth cells and a shorter and rather weak costa.

After conducting a literature search and receiving advice from Dr Benito Tan, we concluded that the specimen was likely to be *Entodontopsis pygmaea* (Paris & Broth.) W.R.Buck & Ireland, a species known from Vietnam, Thailand, China, India and Nepal. On this basis we sent a sample of our specimen to Dr W.R. Buck, co-author of the only monographs dealing with Stereophyllaceae (Buck and Ireland 1985, Ireland and Buck 1994), who confirmed that it is *Entodontopsis pygmaea*.

The following description is based on our Australian material.

Entodontopsis pygmaea (Paris & Broth.) W.R.Buck & Ireland, *Nova Hedwigia* 41: 105 (1985)

Stereophyllum pygmaea Paris & Broth., *Revue Bryologique* 34: 48 (1907)

Type: Vietnam, southern highlands, "Epiphyte sur *Dipterocarpus crispatus*, vallée du Kamly, 1480 m", *P.A. Eberhardt s.n.*, 1906, PC-0100544, PC-0100545, PC-0147673 (digital images seen), H (isotype *fide* Buck and Ireland 1985), *non vidi*.

Plants bright green, somewhat glossy, densely foliate; stems procumbent, pale green; branches arising at irregular intervals, procumbent to weakly ascending, to 1.8 cm long; leaves weakly secund to the ventral side; rhizoids orange-brown, in fascicles. **Stem and branch leaves** similar, ovate-lingulate, widest at $^1/_3$ leaf length, slightly concave, tapering to an acute to obtuse or roundly blunt apex, 0.7–1.11 mm long, 0.38–0.56 mm wide, distinctly narrowed at the base; costa single, broadest at base and failing in the upper to $^1/_2$–$^2/_3$ of the leaf; margins plane, one or both margins revolute at the base, serrulate ± throughout by projecting ends of cells; laminal cells in mid-leaf smooth, elongate, ± linear but often with a slight sigmoid twist, 35–71 × 4.7–7.1 µm, thick-walled, not porose, slightly shorter in the leaf base and distinctly shorter in the leaf apex; alar cells gradually differentiated from laminal cells, wider and shorter, rectangular to rhomboidal but very irregular in size and shape, chlorophyllose.

Paroicous. **Gynoecia** basal on short branches and at intervals along longer stems, paraphyses common. **Androecia** smaller, numerous and distal to gynoecia, paraphyses present but uncommon. **Perichaetial leaves** inconspicuous, smaller than the branch leaves, 0.48–0.59 × 0.14–0.18 mm, ovate-lanceolate, widest below mid-leaf, ecostate; margins entire to weakly serrulate by occasional projecting cell ends; cells as in the stem and branch leaves. **Sporophytes** with red-brown to yellow-brown setae about 4–5 mm long; capsules (including operculum) 0.55–0.70 mm long, 0.33–0.43 mm wide; theca dark brown when mature, urn-shaped, slightly narrowed below the mouth when mature; operculum red-orange when mature, almost hemispherical, with a large blunt apiculus; peristome double, exostome and endostome similar in length, exostome teeth trabeculate; calyptra large, hood-like, side-split; spores spherical to ovoid, smooth to finely papillose, 9.5–11 microns in diameter/long axis. Fig. 2.

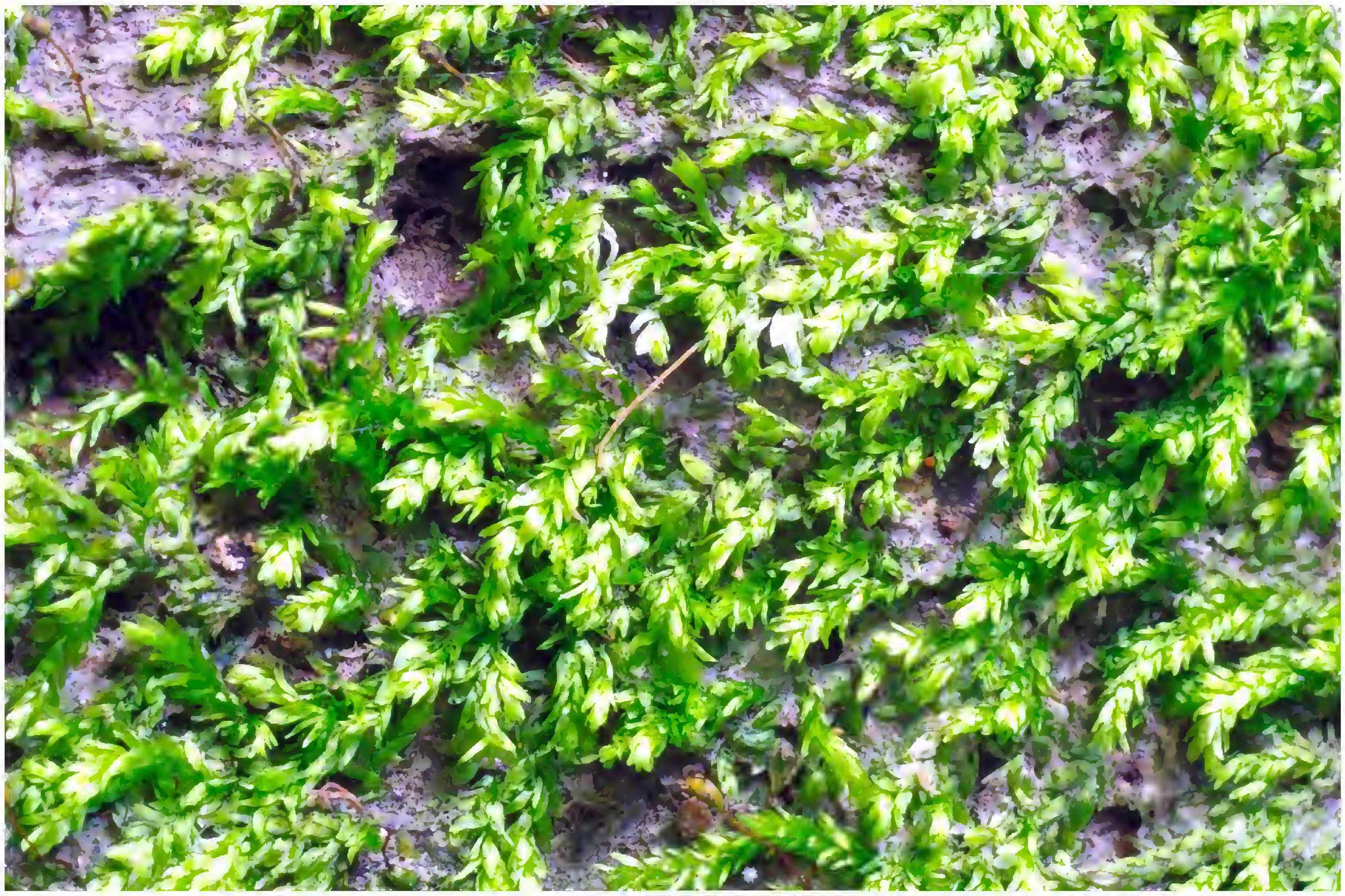


Fig. 1. *Entodontopsis pygmaea* at Lake Barrine, Queensland, growing as an epiphyte. Scale bar (bottom left): 5 mm. *Cairns & Meagher WT-380.*

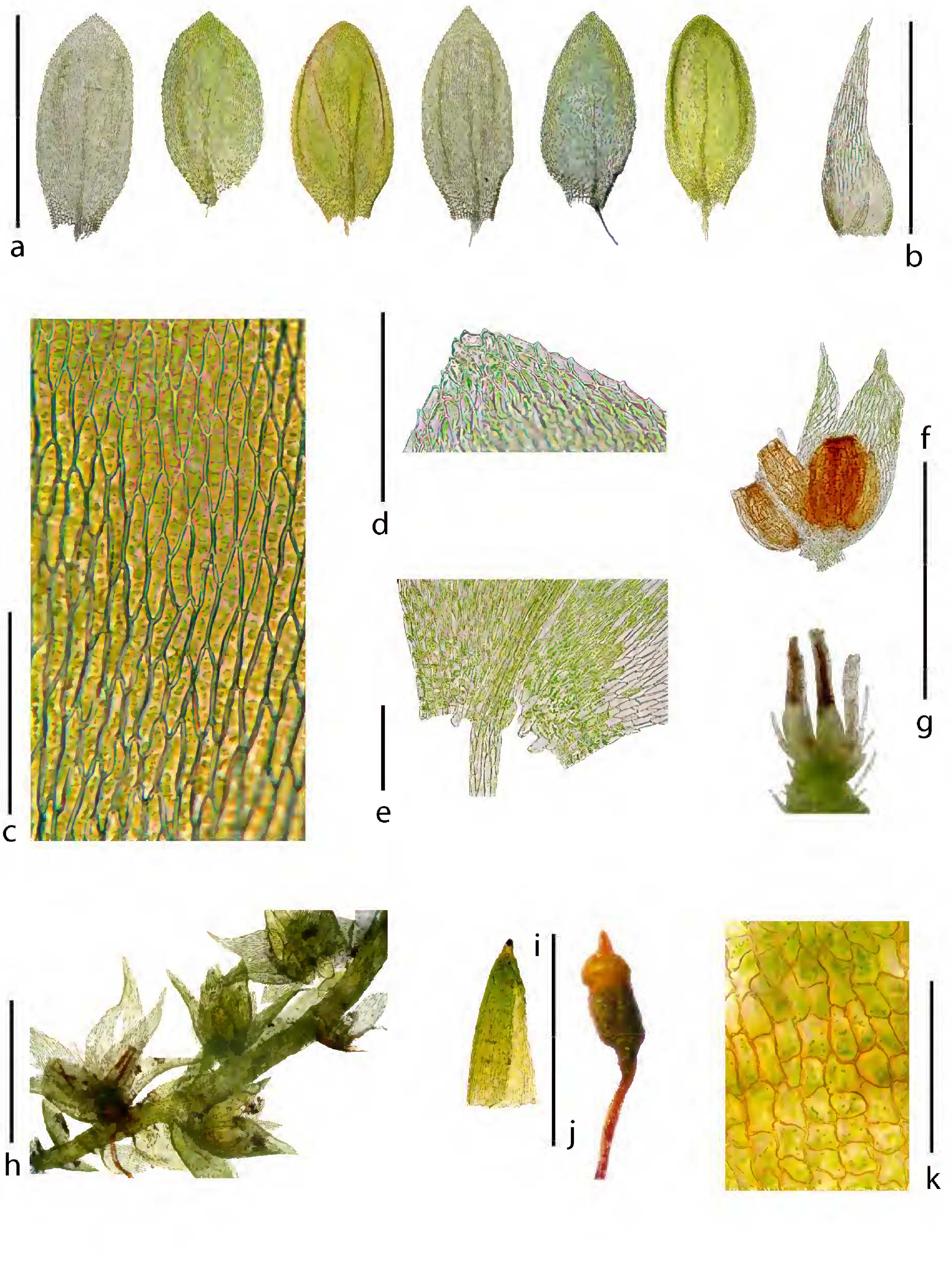


Fig. 2. *Entodontopsis pygmaea*. **a** Series of branch leaves. **b** Perichaetial leaf with paraphyses. **c** Cells in mid-leaf. **d** Leaf apex. **e** Leaf base, showing alar cells. **f** Androecium. **g** Gynoecium with perichaetial leaves removed, showing paraphyses. **h** Portion of stem with one gynoecium (left) and several distal androecia. **i** Calyptra. **j** Capsule with intact operculum. **k** Exothecial cells of capsule wall. Scale bars: **a,i,j** 1 mm. **b,f,g,h** 0.5 mm, **c,d,e,k** 100 µm. *Cairns & Meagher WT-380*.

Specimen examined: Australia: Queensland: Cook (Anonymous 1975): Lake Barrine National Park, 17° 14' 44" S, 145° 38' 21" E, 756 m asl, on bark of tree in a pure colony, *Cairns & Meagher WT-380*, 10 May 2014 (BRI, CNS, NY).

Discussion

Buck and Ireland (1985) resurrected the name *Entodontopsis* Broth. for species of *Stereophyllum* with elongate cells. Apart from the original description by Paris and Brotherus (in Paris 1907), the only other descriptions of *Entodontopsis pygmaea* are identical descriptions in *Flora Yunnanica* (Li 2005) and *Moss Flora of China* (Li 2008), based on collections from Yunnan province, near the border with Vietnam.

An isotype has been identified in the collection of the University of Helsinki (H) (Buck and Ireland 1985), and three specimens in the collection of the Muséum National d'Histoire Naturelle, Paris (PC), where the herbarium of Edouard Paris is held, are listed as isotypes on the museum's database. Although these latter three collections have not been assessed critically, we think there is little doubt that they are all segregates of the original material.

Our translation of the protologue (in Latin and French) is as follows. The collector was Philippe Eberhardt (1874–1942), a French botanist who spent 15 years in eastern Asia and collected in many localities (JSTOR 2014). The paper by Paris (1907) reports entirely on collections by Eberhardt, mostly in the former province of Annan in modern-day southern Vietnam.

The leaf dimension given is obviously the length, although width ('*lata*') is stated in the original, since otherwise *E. pygmaea* would be substantially larger than *E. nitens*, not smaller as stated in the commentary. We also assume that the unusual use of both 'hyaline' and 'chlorophyllose' to describe the alar and basal cells was intended to indicate the transparency of these cells while also noting that they contain chloroplasts.

"Stereophyllum pygmaeum Paris et Broth. *spec. nov.* — Monoicous. In small turfs, loosely imbricate, glistening. Stems creeping, rhizoidal, branched, weakly pinnate. The leaves more or less erecto-patent when moist, oblong-lingulate, $1\frac{1}{3}$ – $1\frac{1}{2}$ mm long, curved, entire or with the rounded apices rather inconspicuously denticulate, asymmetric, costa reaching the middle; with alar and basal cells quadrate, more or less hyaline, thick-walled and chlorophyllose, others very narrow and smooth. Gametangia arising from the stem, androecia persisting, antheridia 6–8, stalked, lacking paraphyses. Perichaetium rhizoidal: 3 or 4 perichaetial leaves, widely lanceolate, acuminate, cells lax and hyaline, costa orange-yellow. Sporophytes frequent: capsule oblong, 1 mm long, 0.5 mm thick, green when maturing, brown when old and then constricted below the mouth, on a stalk 6–8 mm tall, reddish, twisted, erect or bent. Peristome double, exostome teeth lanceolate, trabeculate, furnished with a dividing line; endostome almost the same length, with a hyaline membrane one quarter of the length of the teeth. Annulus? Calyptra? Operculum conical. Spores green, smooth.

Epiphyte on *Dipterocarpus crispatus*, vallée du Kamly, 1480 m.

Very like a miniature *Stereophyllum nitens* Mitt., from which it has been separated, this delicate species is not only distinguished by its extreme smallness, but also by its unequal leaves, rounded at the apex, the entire perichaetia, etc. *Stereophyllum tavoyense* (Hook.) Jaeg. was until now the only species of this genus known in the French East Indies." (Paris and Brotherus, in Paris 1907, p. 48)

A comparison of characters previously reported for *Entodontopsis pygmaea* against our specimen is provided in Table 1. Measurements other than leaf length were not given by Paris and Brotherus (in Paris 1907) and the species was not described in the monograph by Buck and Ireland (1985); most comparisons in the table are therefore against the dimensions given by Li (2005, 2008).

Table 1. Characters reported for *Entodontopsis pygmaea* compared against our specimen.

Character	Paris (1907)	Li (2005, 2008)	Our specimen
Leaf length (mm)	1.3–1.5	1.4–1.8	0.7–1.11
Leaf width (mm)	not given	0.5–0.75	0.38–0.56
Laminal cell length (µm)	not given	75–85	35–71
Laminal cell width (µm)	not given	7–8	4.7–7.1
Capsule length ´ width (mm)	1 × 0.5	1.25 × 0.3–0.4	0.55–0.7 × 0.33–0.43
Seta colour, length (mm)	reddish, 6–8	reddish, 9–10	reddish-brown, 4–5
Paraphyses	lacking in perigonia; not mentioned in perichaetia	not described	present in perigonia and perichaetia
Spores	green, smooth	not described	green, smooth to papillose, spherical to ellipsoid

Our collection (*Cairns & Meagher WT-380*) has leaves and sporophytes consistently smaller than the dimensions of *Entodontopsis pygmaea* given in the original description and in Li (2005, 2008). Such variations in size are not unusual in bryophyte species and may be attributable to phenotypic plasticity (e.g. Buryova and Shaw 2005, Pereira et al. 2013).

Paris and Brotherus (in Paris 1907) found no paraphyses associated with androecia in their collection, but we sometimes found uniseriate paraphyses with elongate terminal cells in perigonia we examined, and more commonly in perichaetia (Figs 2f,g). Paris and Brotherus (in Paris 1907) described the perichaetial leaves as having an orange-yellow costa, but costae were absent in all mature perichaetial leaves examined in our material. Ireland and Buck (1994) noted that in *Entodontopsis* the perichaetial leaves can be 'costate or ecostate within a single perichaetium'.

Spores were described by Paris and Brotherus (in Paris 1907, p. 48) as 'green, smooth', but by Buck and Ireland (1985, p. 101) and Ireland and Buck (1994, p. 10) in the distinguishing characters of the genus as 'spherical to ovoid, papillose'. We found both smooth and finely papillose spores, and the shape varied from spherical to ellipsoid.

To accommodate *Entodontopsis* in the current key to Australian mosses (Buck and Vitt 2006), we suggest the following amendments to the key.

314 (305:) Stem leaves falcate-secund 315

314: Stem leaves straight or weakly secund, not falcate 318

and

319 (318:) Leaves complanate; plants monoicous .... ***Entodontopsis***

319: Leaves not complanate; plants dioicous 319A

319A (319:) Alar cells small (etc., as in existing couplet 319) .... ***Pseudoscleropodium***

319A: Alar cells large (etc., as in existing couplet 319) .... ***Straminergon***

Finally we take the opportunity here to identify the likely type locality for *Entodontopsis pygmaea*, which has previously been uncertain. The original word 'Malaysie' in the commentary following the protologue refers to the former French East Indies (French Indo-China), not the modern country of Malaysia. 'Vallée du Kamly' refers to the modern-day Cam Ly or Camly River. It rises on the Lang-bian plateau north-east of the city of Dalat, in the southern highlands of Vietnam, and flows south-west for about 50 km before entering the Da Dang River. At the time of the collection the plateau had only recently become accessible to foreigners, and Dalat was a small town (Vassal 1905; see Fig. 3). The Kam-Li River at Dalat is just below 1500 m asl where it flows through Dalat (USAMS 1963); the contour elevations given on the map shown in Fig. 3 are about 500 metres less than the actual elevations.

The labels on the collections in PC give the locality as 'Annan, Lang-bian (11°57½' lat. N)', at 1480 m elevation. The Camly valley passes through this latitude downstream of the old town site of Dalat at about 1440 m asl, but also within the old town site at 1485 m asl, which is in perfect agreement with the . The type locality is therefore most likely to be this latter site, which is in the northward-trending section of the valley immediately east of the stables (Ecuries de la Residence) in Fig. 3. If this is correct, the type locality in modern terms would be as follows:

Vietnam, Lam Dong Province, valley of the Camly River at Dalat, 11° 57.5' N, 108° 27.7' E, 1480 m asl.

The provincial capital of Dalat has long since swallowed up the forests that surrounded the old town, and the Camly River has been channelled and dammed for irrigation and hydroelectric works. Xuan Huong Lake now occupies the bend in the river shown in Fig. 3, and the area upstream has been turned over to farms and factories. The probability that the species survives at the likely type locality would be very small indeed, but it might well survive elsewhere in the region.

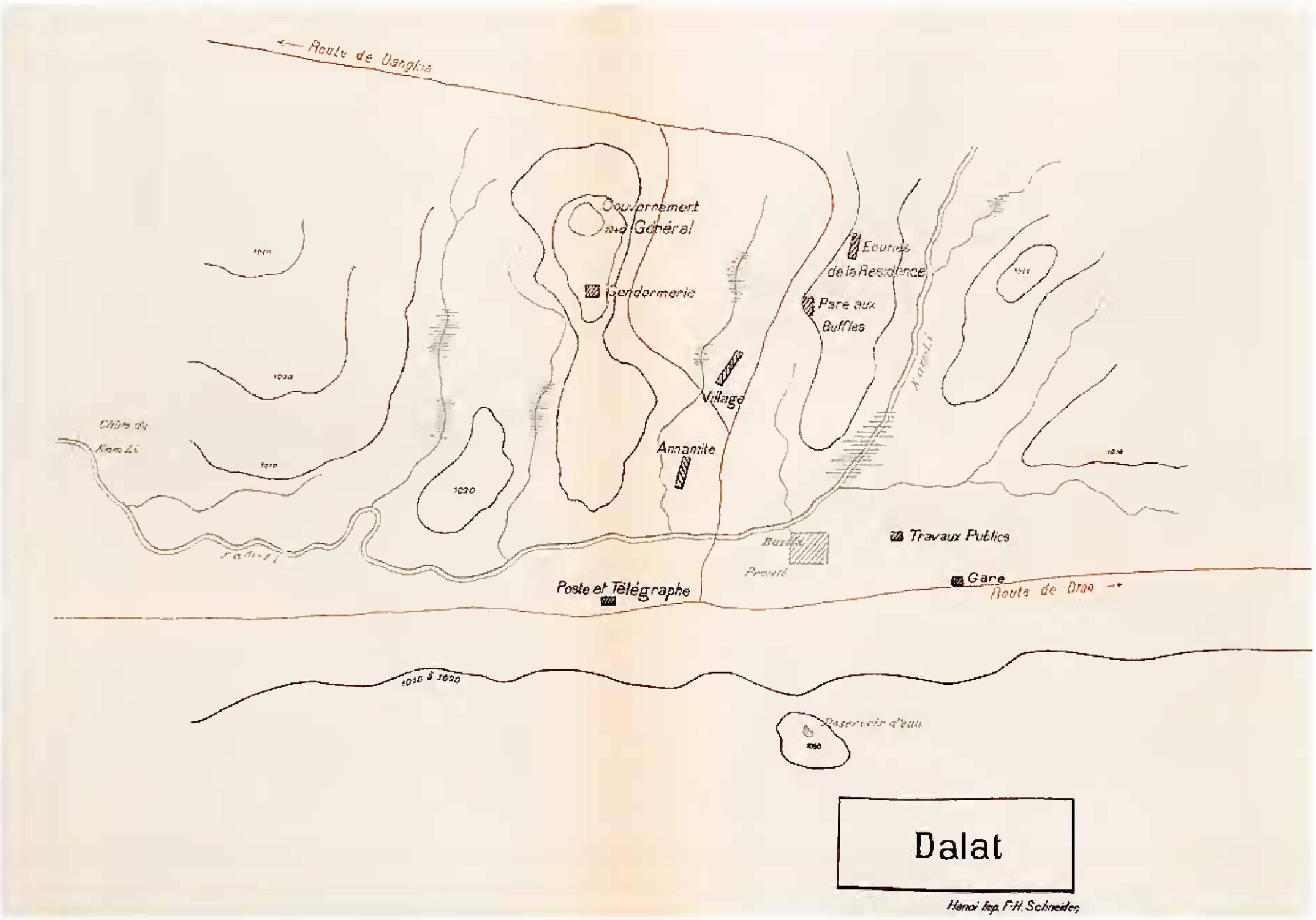


Fig. 3 Dalat and Camly (Kam-Li) River at the time of the collection of the type of *Entodontopsis pygmaea*. Source: Vassal (1905).

Acknowledgments

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